

NxPCM Assessment for Spatial

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Study Title: “Spatial Reorientation of Sensorimotor Balance Control in Altered Gravity” (DSO 635; Spatial)

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Research Gaps

- Gap associated with this study:
 - **SM2:** “What is the time course of recovery of sensorimotor function after long duration spaceflight?”
- **Recommended future studies or gap(s):**
 - The Spatial study provided information for gap **SM2**. The data presented here along with the Functional Task Test and current ground based studies are expected to provide the information needed to determine the risks associated with sensorimotor changes to recover functional mobility and dynamic visual acuity and provide information to update flight standards. No additional studies are recommended at this time. Based on study outcome, we recommend informing medical operations of the necessity to add a flight visual performance test for dynamic visual acuity to post-flight neurological exams.

NxPCM Study Summary:

The Spatial study was designed to examine adaptive changes in the spatial reference frame used for coding orientation and motion as a function of space flight. The subjects consisted of 11 Shuttle, first time space flight, crewmembers (7 males and 4 females) and 11 ground control subjects. Crewmember testing occurred pre-flight (L-60, L-30, and L-10) and post-flight (R+0, 2, 3, and 7/8 days). Adaptive changes were tested by sensory organization tests (SOT) to evaluate postural control. The results indicated decreases in postural stability on R+0, particularly on SOTs without vision or altered proprioceptive feedback. Also, on landing day testing all space flight subjects failed on at least one sway-referenced trial with active head movements leading to the investigator’s recommendation to Medical Operations to add head tilts during posturography testing on crewmembers. Additionally, the study examined the feasibility of altering the re-adaptation process following space flight by providing discordant canal-otolith-somatosensory stimuli using short-radius pitch centrifugation. This limited exposure to centrifugation did not show substantial disruptions in postural performance in the subjects tested in this study.

The investigators believe that the decreases in postural performance that have been identified in this study are consistent with their hypothesis that “changes in the central vestibular processing of the otolith input contributes to the disruption of balance control following g-transitions”.

They recommend future work to identify the incidence and mechanisms responsible for the paroxysmal losses of spatial orientation following space flight known as “flashbacks.”

As a result of this study a new medical requirement for both long and short duration crewmembers has been incorporated and implemented: “Functional Neurological Assessment” (MRO42).